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(71) Applicant *(for all designated States except US)*: LOTEM-PLAST PLASTIC PRODUCTS COMPANY LTD. [IL/IL]; Kibbutz Lotem, 20124 D.N. Carmiel (IL).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: BEN DOR, Rimon [IL/IL]; Kibbutz Lotem, 20124 D.N. Carmiel (IL).

(74) Agents: LUZZATTO, Kfir et al.; Luzzatto & Luzzatto, P.O. Box 5352, 84152 Beer-Sheva (IL).

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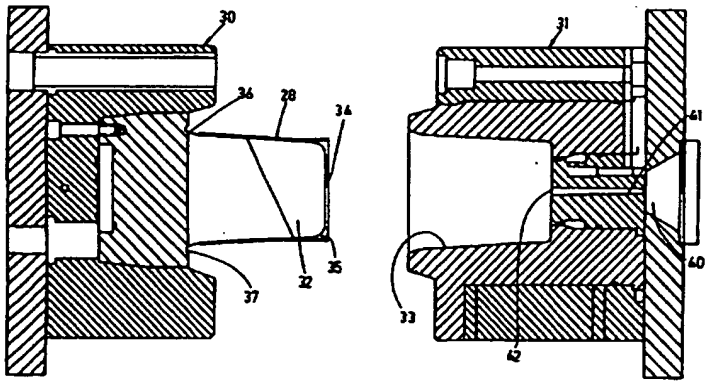

(57) Abstract

In-mold decoration process for making plastic articles having, at least in part, a substantially tubular, in particular cylindrical or quasi-cylindrical or frusto-conical, configuration, decorated, at least in part, with a fabric skin, which comprises the steps of: (a) preparing substantially cylindrical sleeve piece of the fabric to be used as skin for the decorated plastic article, said sleeve piece being of such size and dimensions and elasticity that it is adapted to being imparted the shape and dimensions desired for the final covering or skin of the finished plastic article; (b) providing a mold which has a male half and a female half, which define the surfaces of the substantially tubular portion of the finished plastic article, the male half having a core the surface of which defines the inner surface of said article portion and the female half having a cavity the surface of which defines the outer surface of said article portion; (c) placing said sleeve piece about said core; (d) injecting molten plastic material into said cavity towards said core, whereby to cause it to flow between said sleeve piece and one of said surfaces of said core or said cavity and to press said sleeve piece against the other one of said surfaces, the injected plastic material filling the space between said sleeve piece and said first mentioned surface; (e) allowing plastic material to solidify; and (f) extracting the resulting decorated plastic article from the mold.

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IN-MOLD DECORATION OF SUBSTANTIALLY TUBULAR OBJECTS

Field of the Invention

This invention refers to a process for the manufacture of plastic articles having, at least in part, a substantial tubular, in particular cylindrical or quasi-cylindrical or frusto-conical configuration, such as, e.g., cups, decorated, at least in part, with a fabric, viz. having a fabric covering on at least part of one of their outer and/or inner surfaces, to a mold for the injection molding of such articles and to the decorated articles produced by said process and said mold.

Background of the Invention

As far as we know, no process is available for the production of plastic articles such as cups, or in general substantially tubular objects, open or closed at one end, decorated on their outer surfaces with fabrics, in a single injection molding operation.

It is therefore a purpose of this invention to provide such a process.

It is another object of this invention to provide such a process which consists of a single injection molding step.

It is a further purpose of this invention to provide such a process which is simple and economical and is adapted for the mass production of such articles.

It is a still further purpose of this invention to provide such a process which permits to produce substantially tubular plastic articles that are decorated

with fabrics on at least of their substantially tubular or quasi-cylindrical or frusto-conical surfaces, viz. on an outer or on an inner surface or on both.

It is a still further purpose of this invention to provide such a process which is time saving.

It is a further purpose of this invention to provide such a process which is adapted for automated production.

It is a still further purpose of this invention to provide apparatus means for carrying out such a process.

It is a still further purpose of this invention to provide a mold for carrying out said process.

Other purposes and advantages of the invention will appear as the description proceeds.

Summary of the Invention

The in-mold decoration process for making plastic articles comprising a portion having a substantially tubular, in particular cylindrical or quasi-cylindrical or frusto-conical configuration, decorated, at least in part with a fabric skin, according to the invention, is characterized in that it comprises the steps of:

preparing a substantially cylindrical sleeve piece of the fabric to be used as skin for the decorated plastic article, said sleeve piece being of such size and dimensions and elasticity that it is adapted to being imparted the shape

and dimensions desired for the final covering or skin of the finished plastic article,

providing a mold which has a male half (hereinafter "male mold") and a female half (hereinafter "female mold"), which define the surfaces of the substantially tubular portion of the finished plastic article, the male mold having a core the surface of which defines the inner surface of said article portion and the female mold having a cavity the surface of which defines the outer surface of said article portion,

placing said sleeve piece about said core,

injecting molten plastic material into said cavity towards said core, whereby to cause it to flow between said sleeve piece and one of said surfaces of said core or said cavity and to press said sleeve piece against the other one of said surfaces, the injected plastic material filling the space between said sleeve piece and said first mentioned surface,

allowing plastic material to solidify, and

extracting the resulting decorated plastic article from the mold.

By "substantially tubular portion" of a plastic article is meant a hollow portion, having an inner and an outer surface, the cross-sections of which, taken on parallel planes, are equal or have the same shape but moderately different sizes. The line perpendicular to said planes will be called the "axis" of the article, and will be in most cases, though not necessarily, the axis of symmetry of the article. If said cross-sections are circular, the axis of the article is its axis of symmetry and the substantially tubular portion is cylindrical or quasi-cylindrical or frusto-conical. Since this is the most common case, specific reference will be made to it hereinafter, but it should be stressed that this involves no limitation and that the invention may be applied to articles having portions the cross-sections of which are not

circular, e.g. elliptical or polygonal. When reference is made hereinafter to the outer or inner surface of the plastic article, without further specification, it should be understood that what is meant is the outer or inner surface of substantially tubular portion of the plastic article.

When the process is applied to decorating surface of the article with fabric, it comprises the following steps:

preparing a substantially cylindrical sleeve piece of the fabric to be used as skin for the decorated plastic article, said sleeve piece being of such size and dimensions and elasticity that it is adapted to being imparted the shape and dimensions desired for the final covering or skin of the finished plastic article,

providing a mold which has a male half (hereinafter "male mold") having a core which defines the inner surface of the finished plastic article and having a female half (hereinafter "female mold") having a cavity the surface of which defines the outer surface of the finished plastic article,

placing said sleeve piece about said core,

injecting molten plastic material into said cavity towards said core, whereby to cause it to flow between said core and said sleeve piece placed thereupon and to press said sleeve piece against said surface of said cavity, the injected plastic material filling the space between said sleeve piece and said core,

allowing plastic material to solidify. and

extracting the resulting decorated plastic article from the mold.

When the process is applied to decorating the inner surface of the article with fabric, it comprises the following steps:

preparing a substantially cylindrical sleeve piece of the fabric to be used as skin for the decorated plastic article, said sleeve piece being of such size and dimensions and elasticity that it is adapted to being imparted the shape and dimensions desired for the final covering or skin of the finished plastic article,

providing a mold which has a male half (hereinafter "male mold") having a core which defines the inner surface of the finished plastic article and having a female half (hereinafter "female mold") having a cavity the surface of which defines the outer surface of the finished plastic article,

placing said sleeve piece about said core,

injecting molten plastic material into said cavity towards said core, whereby to cause it to flow between said surface of the cavity of said female mold and said sleeve piece and to press said sleeve piece against said core, the injected plastic material filling the space between said sleeve piece and said surface of said cavity,

allowing plastic material to solidify. and

extracting the resulting decorated plastic article from the mold.

By "sleeve piece" is meant herein a tubular body of fabric which has the dimensions of the fabric skin that will decorate the plastic article.

The plastic article may have an open substantially tubular configuration, but, more often, will have a transverse wall closing it at one end, as in the case of a cup or the like. In this case, the molten plastic material will be injected into said cavity of said female mold so as to impinge on the end of said core and the direction of the injected stream will be along the axis of said core, so that said stream will flow symmetrically over said core end, towards its periphery, and form said transverse wall, before flowing between said sleeve piece and

the core or the female mold cavity, to form the substantially tubular portion of the article. On the contrary, if this latter has an open configuration, the plastic melt will be injected from ports of the female mold opening about the periphery of said core or of said sleeve piece, so as to be immediately directed to flow flowing between said sleeve piece and the core or the female mold cavity.

The preparation of the sleeve piece comprises:

a) providing a fabric strip of the material which is to constitute the covering or skin of the article, either by making it directly from filaments, fibers or yarns, or by cutting a fabric into strips;

b) winding said strip in spiral fashion to form a tube of the desired diameter, which is essentially endless, viz. may be as long as allowed by the length of the strip; and

c) cutting said tube into sleeve pieces of a length determined by the length of the plastic article to be decorated.

Preferably, according to the invention, the fabric material is thermoplastic, at least in part, a 25% (by weight) content of thermoplastic fibers being a preferred minimum and the non-thermoplastic fibers being preferably cotton. The thermoplastic fibers can be of any kind, e.g. from polyamides, polyesters and blends thereof, etc. The cutting operations are carried out by or with the application of heat, so that the various threads will be welded along the cut and the fabric will not unravel. Woven fabrics are preferred because of their elasticity, but non-woven fabrics can be used as well.

The winding of the fabric strip is made in spiral fashion, viz. in such a way that the edges of the strip form a spiral. The angle at which the fabric strip is

wound to form a tube is important to the elastic behavior of the sleeve piece. The acute angle between the tangent to said spiral and the plane of the cross-section of the wound tube (when this latter is in its distended configuration) - hereinafter "the winding angle" - may vary between 15° and 45°, and preferably between 20° and 30°. If the fabric strip is directly woven as such or is derived from a woven fabric bolt cut along its length, said longitudinal direction coincides with the direction of the warp. Different longitudinal directions, however, may be chosen for the strip, taking into account the elastic properties of the fabric, to achieve optimal results. E.g., a woven fabric bolt may be cut into strips at an angle to its length; or the strip may be of non-woven fabric, in which case a warp direction cannot be defined.

The winding of the fabric strip into a tube preferably involves a certain overlap of adjoining fabric spiral turns. This overlap should preferably be 3 to 5 mm. The adjoining fabric spiral turns should preferably be bonded in their overlapping zones. Various means are available in the art for doing so. Thus, an adhesive may be applied to said overlapping zones, e.g. by spraying at a sufficiently high temperature so that the adhesive be adequately fluid, applying pressure to said zones to promote penetration of the adhesive into the fabric, and cooling the adhesive. Alternatively, a thin strip of plastic adhesive may be applied between adjoining fabric spiral turns, where they overlap, and pressure may be applied to promote penetration of the adhesive into the fabric. Further, ultrasound bonding may be applied to said overlapping zones by using apparatus available on the market. All these bonding methods are known to persons skilled in the art and their use in carrying out this invention involves no particular problems.

The inner diameter - hereinafter called "the diameter", in view of the small thickness of the fabric - of the wound tube and therefore of the sleeve piece (in their distended condition) is equal to the outer diameter of the core, if this latter is cylindrical, or, if this latter is frusto-conical, is comprised between the minimum and the maximum diameter of the core. A moderate conicity, viz. taper, of the final product can be obtained by stretching the sleeve as a consequence of the pressure applied to it by the injected plastic material. In any case, a moderate conicity of the molded piece, and therefore of the core, e.g. between 0 and 5°, is always desired to facilitate the ejection of the molded piece.

The injection is carried out through the female mold in an average direction that is parallel to the axis of the male mold core. If the plastic article is closed at one end, the injection is carried out preferably through an injection channel that has an outlet port located in the female mold cavity and centered on said axis. Since the sleeve has a slightly larger circumference than the forward end of the core, viz. the cross-section of the core that is closest to said outlet port, the plastic melt firstly flows over the core forward end towards its periphery, to form the closing wall of the article, and then penetrates into the gap between said sleeve and said core and flows all the way to the opposite or rearward end of the core, exerting an inside pressure on said sleeve which causes it to be applied to and pressed against the inner surface of the female mold cavity.

The plastic material employed must have a high flowability, viz. a relatively low viscosity in the molten state and the injection temperature, and it must be injected at a slow rate, at least during the first portion of the injection and until about 30% of the volume of the plastic material has been injected. This

is necessary to avoid excessive shear stresses in the fabric material. The plastic material has preferably a Melt Flow Index of at least 10 and not more than 30, and the injection is preferably effected so that the speed at which the front of the molten plastic stream advances is 20 to 56 mm per minute.

Brief Description of the Drawings

In the drawings:

Fig. 1 is a schematic view, at a reduced scale, of a fabric strip and the portion of it constituting a skin piece, according to an embodiment of the invention;

Fig. 2 is a lateral view of a cup covered with spirally wound fabric, according to an embodiment of the invention;

Fig. 3 is an axial cross-section of the same cup;

Fig. 4 is a block diagram of a process according to an embodiment of the invention;

Fig. 5 is a schematic cross-section of a mold according to an embodiment of the invention, taken on a plane passing through the axis of the mold core, the mold being in the open condition;

Fig. 6 is a schematic cross-section similar to that of Fig. 5, the mold being in the closed condition, at the end of the injection phase.

Detailed Description of Preferred Embodiments

Referring now to Figs. 2 and 3, a cup, generally indicated at 10, constitutes an example of a decorated plastic article according to an embodiment of the invention and made by a process and a mold according to an embodiment of the invention. Cup 10 has a plastic body which comprises a bottom 11 and a wall 12 having a conical portion 13 and a flared-out annular rim 14, which is not covered by sleeve piece 15, hereinafter described. The thickness of the wall 12, in this example, is constant over all its length, but this is not

necessary and the thickness might be varied by suitably dimensioning the mold to be described. Further, reliefs or recesses may be provided in the plastic body for decorative or other purposes. Wall 12 is covered on the outside, for its most part, with a fabric covering or sleeve piece generally indicated at 15. The sleeve piece is formed from a tube, obtained from a fabric strip wound upon itself in spiral form with a winding angle from 15° to 45°, as indicated by the spiral edges 20, successive turns of the spiral having an overlap indicated at 17, and cut at the edges 18 and 19.

While a specific structure of decorated article has been illustrated, which is essentially frusto-conical, closed at its narrower end, it should be understood that the invention can apply to any configuration that has a portion of that shape or has a portion the shape of which is substantially tubular or, in particular, substantially cylindrical. The transverse cross-section of said substantially tubular portion may be circular, and then the said portion will be cylindrical or conical, or it may be non-circular, viz. for example, elliptical or even polygonal. Further, said cross-section may be constant along the length of the article, or it may vary, as it does, e.g., in conical articles.

Fig. 4 is a block diagram of a process according to an embodiment of the invention. In Fig. 4, the following numerals correspond to the following steps-materials or operations:

Block No.	Step
60	FABRIC STRIP STOCK
61	WINDING IN SPIRAL FORM
62	TUBE
63	CUTTING
64	SLEEVE PIECE
65	OPEN MOLD
66	LOADING SLEEVE PIECE ON MOLD CORE
67	CLOSING MOLD
68	INJECTING PLASTIC
69	FINISHED ARTICLE

As illustrated in Fig. 4, the process according to a typical embodiment of the invention comprises winding (61) a fabric strip stock (60) at a convenient angle to the longitudinal direction (as hereinbefore defined) to provide (62) an essentially endless, cylindrical tube, viz. a tube the length of which depends only on the length of the available fabric strip, and then transversely cutting (63) said tube to pieces (64) of the length that is required for the decorated articles to be made - which pieces are called herein "sleeve pieces". As stated hereinbefore, the fabric strip stock (60) may be obtained by directly producing a fabric ribbon of the appropriate width, or by cutting a fabric stock, of any width, into strips of the appropriate width.

As shown in Fig. 1, a fabric strip 21 (shown as broken off in the drawing) is wound about a winding axis 22 at a winding angle α, said winding angle

being the angle between the longitudinal direction of the fabric and the perpendicular to the winding axis. In the finished article, shown in Fig. 2, the winding angle is seen as the angle between the spiral, defined by the overlapping edges of the adjacent fabric spiral turns, and the transverse cross-section of the tubular article. As has been said, the angle α may vary from 15° to 45° and preferably from 20° to 30°. Generally, it is preferred that the spiral defined by adjacent and overlapping fabric edges have only one turn over the entire article, or in other words, that the pitch of the overlap spiral be substantially equal to the length of the fabric covering, which is about the same or slightly less than the axial dimension of the article. This preferred condition is expressed by:

$tg\alpha = L/\pi d$, wherein L is the length (axial dimension) of the fabric covering and d its diameter. The fabric preferably comprises at least 25% by weight of thermoplastic fibers, e.g., polyamide or polyester fibers, the non-thermoplastic fibers being preferably cotton, and is cut by or with the application of heat, in order to fuse the margins of the cut and prevent any unraveling of the fabric yarns. The edges 18 and 19 (see Fig. 2) represent the lines along which the (endless) fabric tube has been cut to provide a final fabric sleeve piece 28 (see Fig. 5) to be used for the manufacture of one article according to the invention. The sleeve piece, if unwound would appear as the trapezoidal piece 16 evidenced by hatching in Fig. 1.

The mold for the in-mold decoration of the plastic article, according to an embodiment of the invention, is shown in the open condition in Fig. 5. It comprises a male half or male mold, generally indicated at 30, and a female half or female mold, generally indicated at 31. Male mold 30 has a core 32 and female mold 31 has a corresponding cavity 33. The end of core 32, indicated at 34 and called the forward end of the core, is the part thereof that

penetrates most deeply into cavity 33. Core 32 has a mainly frusto-conical outer surface, which has a rounded connection 35 to core end 34 and a flared-out shoulder 36 at its rear end. A narrow groove 37 is formed at the base of the core. Female mold 31 has a plastic melt inlet 40, which conveys the molten plastic to injection channel 41, coaxial with core 32 and opening on an injection port 42.

Sleeve piece 28 is placed on core 32 (66 in Fig. 4), as seen in Fig. 5. The thickness of the skin piece is exaggerated in the drawing, for illustrative purposes. As seen in Fig. 5, the sleeve piece 28 has an inner diameter that is approximately equal or close to the average diameter of the core. The elasticity of the fabric sleeve piece permits to apply it onto the main, frusto-conical portion of the core, even though its diameter is slightly less than the largest diameter D of said main portion and is intermediate between said diameter D and diameter d of the forward end of the core. The sleeve piece is slipped onto the core, and, thanks to its elasticity, can be slipped to the end of the frusto-conical portion of the core. However, it does not penetrate into groove 37, where uncoated rim 14 of the finished article will form. Its forward end projects slightly from the forward end 34 of the core, actually by an amount that equal to or slightly less than the thickness of bottom 11 of cup 10.

When the mold is closed (67 in Fig. 4) and the molten plastic matter is injected (68), the injected plastic stream impinges on the forward end 34 of core 32 and flows symmetrically towards the periphery of said core end, between it and the bottom of cavity 33, which faces it. From said core end periphery, it penetrates and flows between core 32 and sleeve piece 28, towards the rear end or base of the core, finally to fill groove 37. In its flow, it

exerts a pressure on the inner surface of the sleeve piece 28. The sleeve piece is sufficiently elastic, due to the properties of the fabric and to the fact that it is made from a strip cut at an angle to its longitudinal direction and spirally wound, to expand somewhat under the pressure of the injected stream, until it is retained by the female mold cavity 33. The plastic stream causes the sleeve piece to assume a distended, round shape against the female mold and forms a layer between it and the core. However, in order to be sure that the sleeve piece does not have any wrinkles and is smooth and taught, it must not have at any point thereof, a diameter that exceeds by more than about 1-4 mm that of the underlying portion of the core. Where the sleeve piece 28 is in contact with the core and expands to contact the female mold, it becomes detached from the core by a distance equal to the thickness of the wall 12 of the finished article: it is sufficiently elastic to increase its diameter as required. Beyond the edge 19 of the sleeve, the plastic stream penetrates into cavity 37 and forms uncoated rim 16 of cup 10.

The elasticity of the sleeve piece should be sufficient for it to permit to expand so as to contact the female mold at all points in spite of the possible conicity of the molded piece. For this purpose, it should be able to increase its diameter by an amount that may be in general in the order of 5% to 20%. As an illustrative example, one may consider a cup the conical portion of which has a maximum diameter of 75 mm and a minimum diameter of 64 mm. If the sleeve piece has a diameter of 67 mm, it must expand, at the point of maximum diameter of the cup, by about 10.7%. The corresponding conicity of the core, in this case, is arctg(5.5/L), wherein L is the length of the conical portion of the cup, and if said length is 10.5 cm, the conicity angle is about 3°.

The manufacture of cylindrical or quasi-cylindrical articles can be carried out in the same way, by using molds having a cylindrical core and a cylindrical female mold cavity.

In order to carry out the aforesaid embodiment of the invention, all plastic materials that can be injection molded can be used. The most preferred ones are the polyolefins and soft PVC. The injection pressure varies preferably from about 100 to about 500 Bar. The plastic is preferably injected at such a speed that the injection is completed within a period of 3 to 20 seconds and the entire injection cycle lasts between 20 seconds and one minute: however, these times are only preferred and indicative and may be varied by persons skilled in the injection molding art to adapt the process to each particular case.

Thereafter, the injected article is allowed to solidify, and the mold is opened and the article is ejected by ejectors, not indicated in the drawings as they are conventional in the injection molding art. The finished article is the obtained (69 in Fig. 4).

It is clear that the operations of preparing the sleeve and loading it into the mold over the core can be carried out manually, but they can also be rendered automatic, and the injection phases can also be automatically controlled, so that the process according to the invention can give rise to a production line having high productivity, and which is time-saving and labor-saving.

While an embodiment of the invention has been described by way of illustration, it will be apparent that the invention can be carried out by

skilled persons with many modifications, variations and adaptations, without departing from its spirit or exceeding the scope of the claims.

CLAIMS

1. In-mold decoration process for making plastic articles having, at least in part, a substantial tubular, in particular cylindrical or quasi-cylindrical or frusto-conical, configuration, decorated, at least in part, with a fabric skin, which comprises the steps of:

preparing a substantially cylindrical sleeve piece of the fabric to be used as skin for the decorated plastic article, said sleeve piece being of such size and dimensions and elasticity that it is adapted to being imparted the shape and dimensions desired for the final covering or skin of the finished plastic article,

providing a mold which has a male half and a female half, which define the surfaces of the substantially tubular portion of the finished plastic article, the male half having a core the surface of which defines the inner surface of said article portion and the female half having a cavity the surface of which defines the outer surface of said article portion,

placing said sleeve piece about said core,

injecting molten plastic material into said cavity towards said core, whereby to cause it to flow between said sleeve piece and one of said surfaces of said core or said cavity and to press said sleeve piece against the other one of said surfaces, the injected plastic material filling the space between said sleeve piece and said first mentioned surface,

allowing plastic material to solidify, and

extracting the resulting decorated plastic article from the mold.

2. Process according to claim 1, for decorating with fabric the outer surface of the article, which comprises the steps of:

preparing a substantially cylindrical sleeve piece of the fabric to be used as skin for the decorated plastic article, said sleeve piece being of such size and dimensions and elasticity that it is adapted to being imparted the shape and dimensions desired for the final covering or skin of the finished plastic article,

providing a mold which has a male half having a core, which defines the inner surface of the finished plastic article, and a female half having a cavity the surface of which defines the outer surface of the finished plastic article,

placing said sleeve piece about said core,

injecting molten plastic material into said cavity towards said core, whereby to cause it to flow between said core and said sleeve piece placed thereupon and to press said sleeve piece against said surface of said cavity, the injected plastic material filling the space between said sleeve piece and said core,

allowing plastic material to solidify. and

extracting the resulting decorated plastic article from the mold.

3. Process according to claim 1, for decorating with fabric the inner surface of the article, which comprises the steps of:

preparing a substantially cylindrical sleeve piece of the fabric to be used as skin for the decorated plastic article, said sleeve piece being of such size and dimensions and elasticity that it is adapted to being imparted the shape and dimensions desired for the final covering or skin of the finished plastic article,

providing a mold which has a male half having a core which defines the inner surface of the finished plastic article, and a female half having a cavity the surface of which defines the outer surface of the finished plastic article,

placing said sleeve piece about said core,

injecting molten plastic material into said cavity towards said core, whereby to cause it to flow between said surface of the cavity of said female half and said sleeve piece and to press said sleeve piece against said core, the injected plastic material filling the space between said sleeve piece and said surface of said cavity,

allowing plastic material to solidify. and

extracting the resulting decorated plastic article from the mold.

4. Process according to claim 1, for making an article having a transverse wall closing it at one end, wherein the molten plastic material is injected into the cavity of the female mold half in the direction of the axis of the core, whereby to impinge on the forward end of said core and to flow symmetrically over said core end towards its periphery.

5. Process according to claim 1, wherein the preparation of the sleeve piece comprising wrapping a fabric strip in spiral fashion to form a tubular body of the desired diameter and cutting the same to pieces of the desired length.

6. Process according to claim 5, wherein the fabric strip contains at least 25% of thermoplastic fibers and the cutting operations are carried out by or with the application of heat.

7. Process according to claim 5, wherein the non-thermoplastic fibers contained in the fabric strip are cotton fibers.

8. Process according to claim 5, wherein the tubular body is prepared by winding the fabric strip at a winding angle comprised between 15° and 45°.

9. Process according to claim 8, wherein the winding angle is comprised between 20° and 30°.

10. Process according to claim 2, wherein the sleeve piece has a diameter comprised between the minimum and the maximum diameters of the core of the mold.

11. Process according to claim 2, wherein the sleeve piece is placed the male mold half core so that it projects slightly from the forward end of said core.

12. Process according to claim 1, wherein the fabric strip is chosen from among woven and non-woven fabrics.

13. Process according to claim 12, wherein the fabric strip contains at least 25% by weight of thermoplastic material.

14. Process according to claim 1, wherein the plastic is chosen from among polyolefins and soft PVC.

15. Process according to claim 1, wherein the plastic the plastic material has a Melt Flow Index of at least 10 and not more than 30.

16. Process according to claim 1, wherein the injection is preferably effected so that the speed at which the front of the molten plastic stream advances is 20 to 56 mm per minute.

17. Mold for the production of in-mold decorated plastic articles having, at least in part, a substantial tubular or quasi-cylindrical or frusto-conical

configuration, decorated, at least in part, with a fabric, comprising a male half having a core which defines the inner surface of the finished plastic article and having a female half the cavity of which defines the outer surface of the finished plastic article, at least an injection orifice being provided in said female half.

18. Mold according to claim 17, wherein the injection orifice is aligned with the core axis.

19. Mold according to claim 17, wherein the core is substantially frusto-conical, at least in part.

20. Plastic articles having a substantial tubular portion, decorated with a fabric covering on at least one of the surfaces of said portion.

21. Plastic articles according to claim 20, wherein the fabric covering has a spiral configuration.

22. Plastic articles according to claim 21, wherein the spiral configuration has a winding angle comprised between 15° and 45°.

23. Plastic articles according to claim 22, wherein the spiral configuration has a winding angle comprised between 20° and 30°.

24. Plastic articles according to claim 20, wherein the fabric covering has been elastically stretched, at least in part, during the injection molding and is firmly bonded to the plastic body of the finished article.

25. Plastic articles according to claim 20, wherein the fabric covering is made of a fabric containing at least 25% of thermoplastic material.

26. Plastic articles according to claim 25, wherein the non-thermoplastic material contained in the fabric covering is cotton.

27. Plastic articles according to claim 20, wherein the plastic is chosen from among polyolefins and soft PVC.

28. In-mold decoration process, substantially as described and illustrated.

29. Mold for the production of in-mold decorated plastic articles, substantially as described and illustrated.

30. Plastic articles, substantially as described and illustrated.

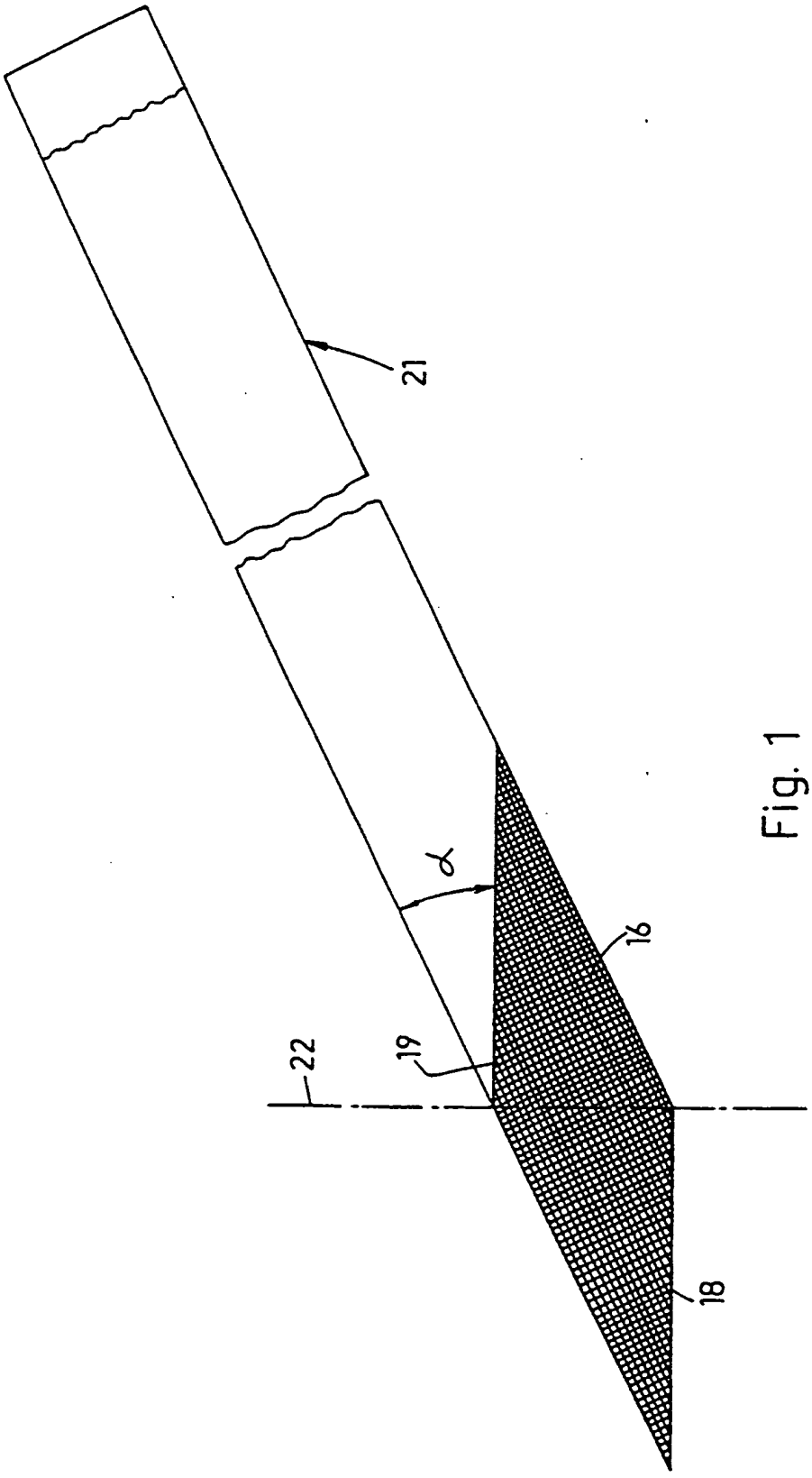


Fig. 1

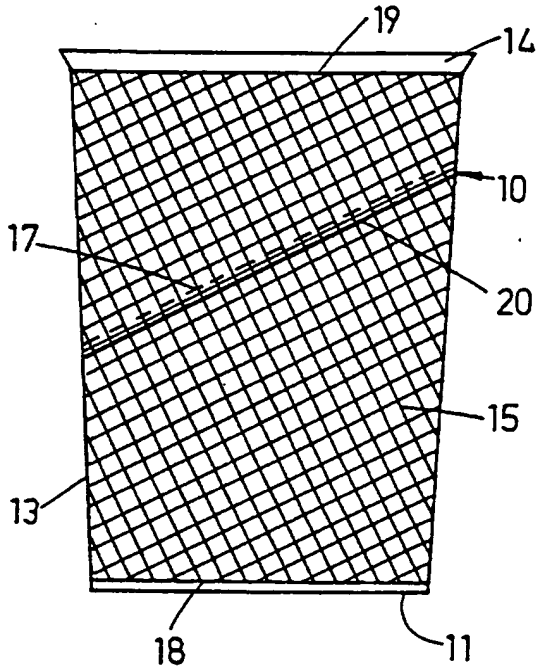


Fig. 2

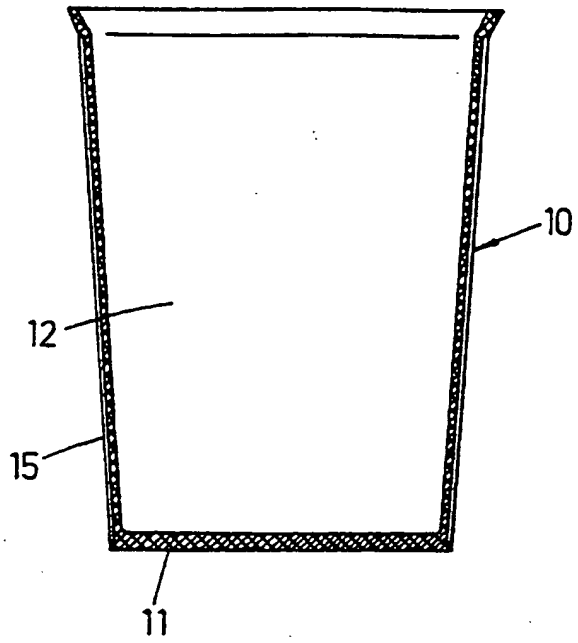


Fig. 3

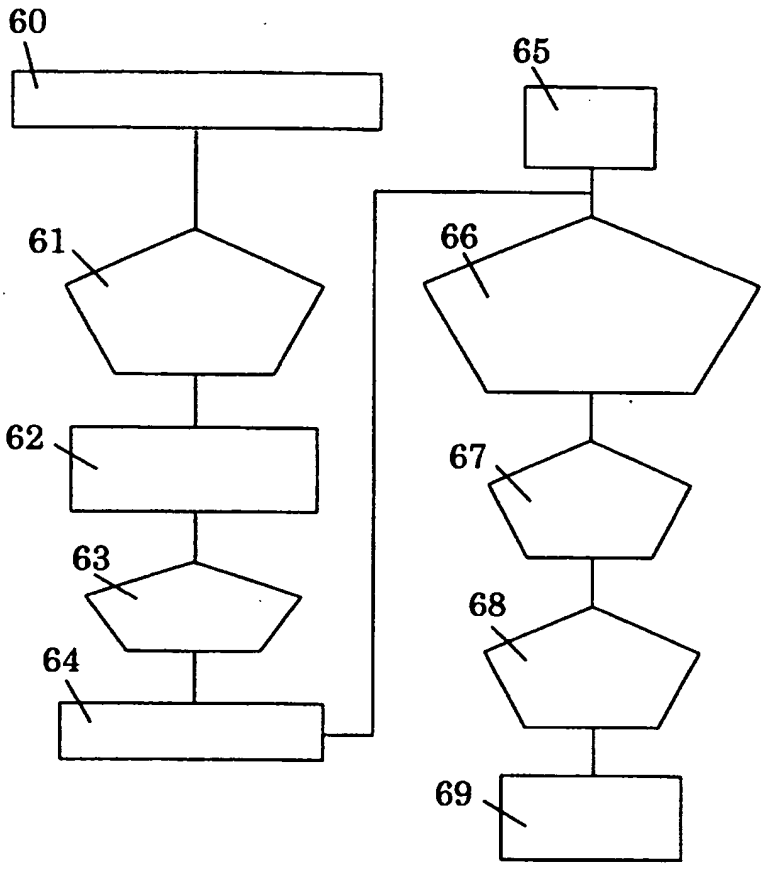


Fig. 4

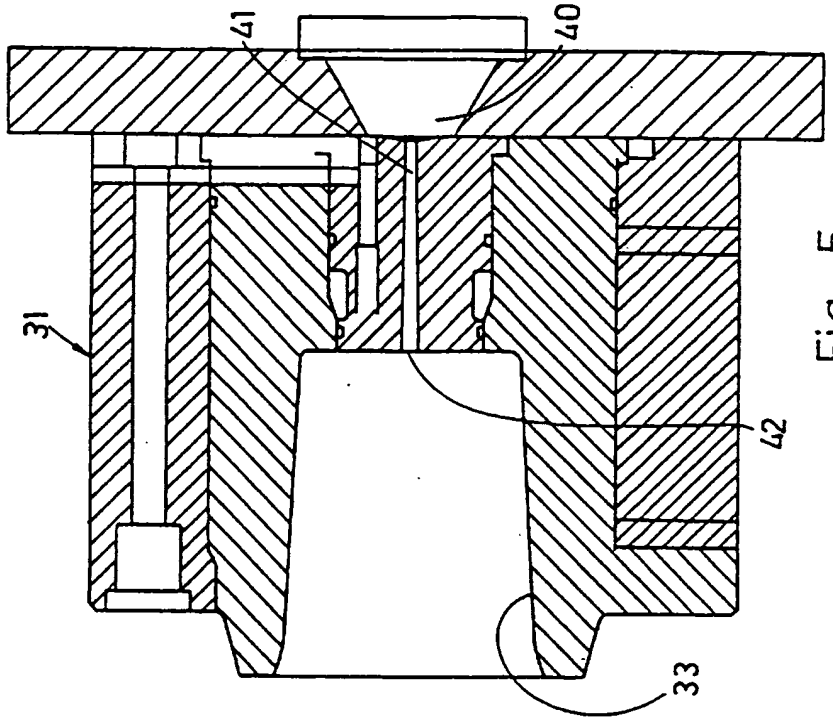
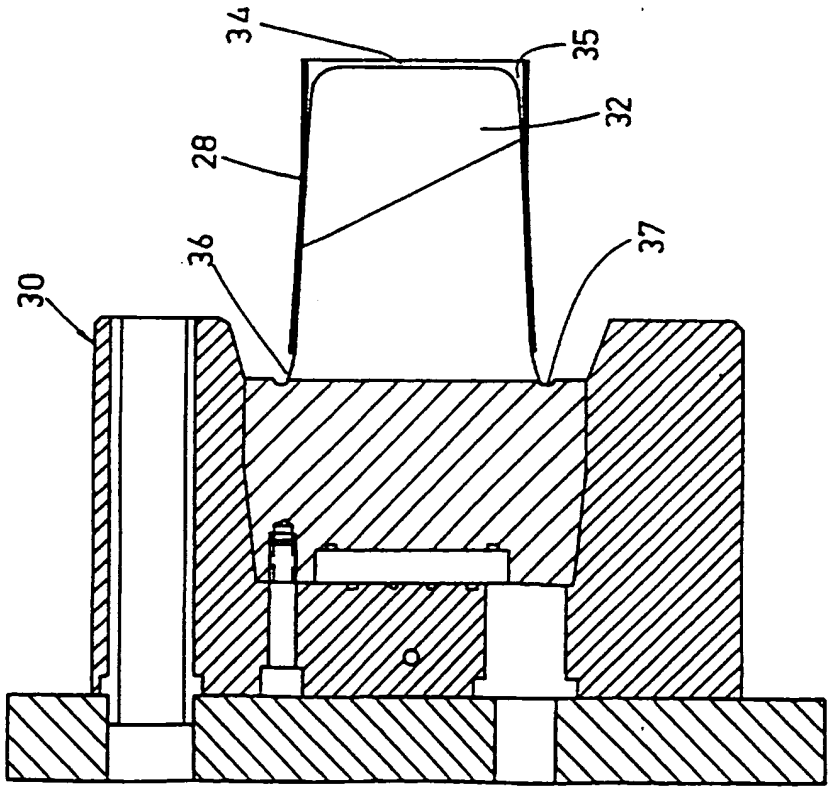


Fig. 5



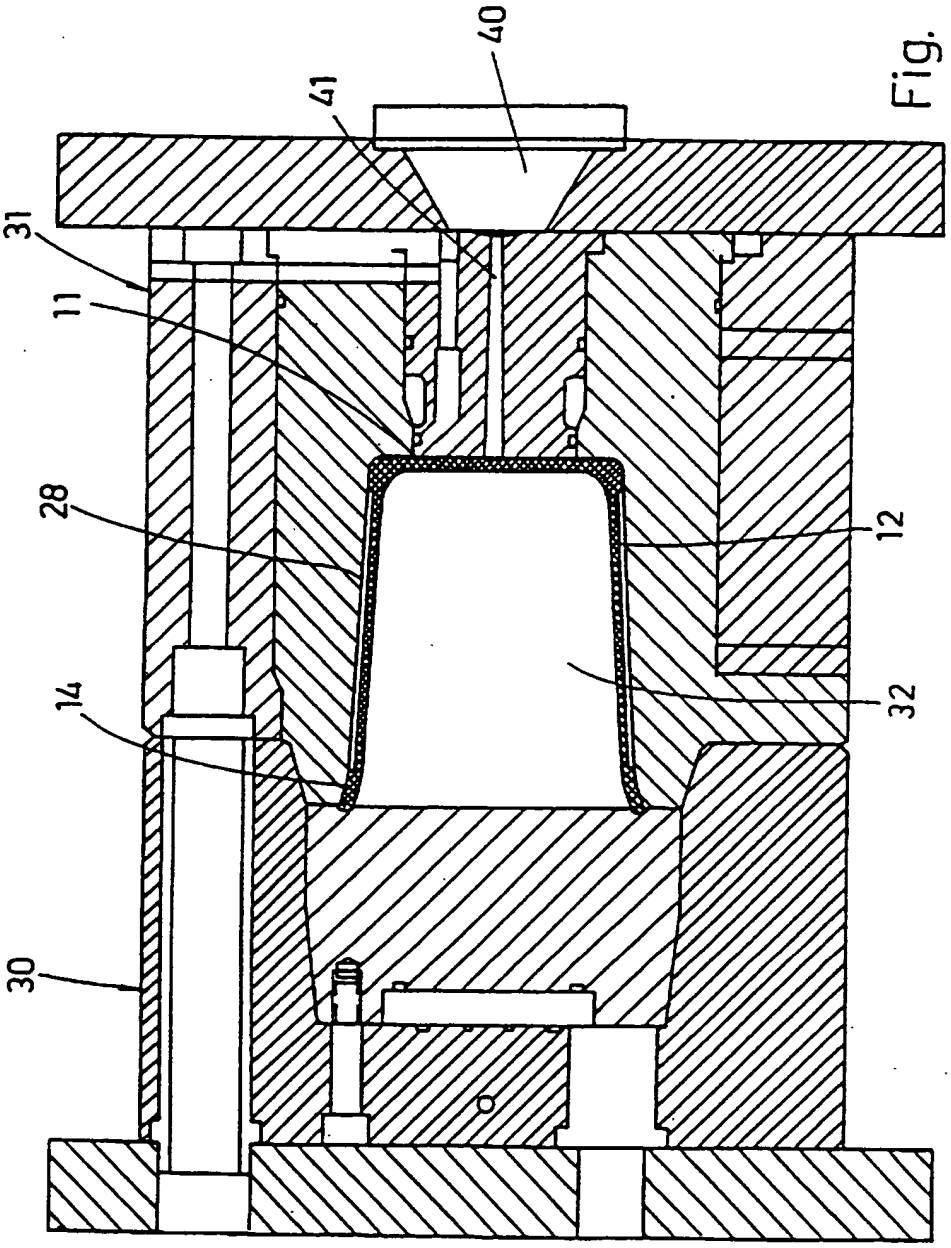


Fig. 6

INTERNATIONAL SEARCH REPORT

Inter[illegible]pplication No
PCT/IL 97/00043

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B29C45/14 B65D1/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B29C B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3 101 994 A (L. HARTMANN) 27 August 1963	1-4,12, 17-19, 24,28,29
X	see column 9, line 70 - column 10, line 12; claim 1; figures 3-8	20,30
Y	GB 2 082 113 A (BRECO KUNSTSTOFFVERARBEITUNGS-GMBH) 3 March 1982	1,3,12, 17,20, 24,28-30
	see the whole document	
Y	EP 0 395 585 A (FUJI SEAL IND CO LTD) 31 October 1990	1,2,4, 17-20, 24,28-30
	see column 10, line 7 - line 21; figure 9	
	see column 10, line 50 - line 56	
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 May 1997	02. 06. 97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Bollen, J

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	EP 0 466 947 A (CAHILL JOHN W) 22 January 1992 see column 4, line 21 - line 46; claims 1-4; figures	1,2,4, 12,17, 18,20, 24,28-30
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